# AN EVALUATION OF THE POSTOPERATIVE ANALGESIC EFFICACY AND OPIOID SPARING EFFECT OF TRANSVERSUS ABDOMINIS PLANE BLOCK AFTER CAESAREAN SECTION

Dissertation submitted to

**THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY**

*in partial fulfillment for the award of the degree of*

**DOCTOR OF MEDICINE**

IN

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**THANJAVUR – 613004.**

**MARCH 2011**

# CERTIFICATE

This is to certify that the dissertation entitled, "***An evaluation of the postoperative analgesic efficacy and opioid sparing effect of Transversus abdominis plane block after caesarean sections",*** submitted by **Dr. P. RATESH THANGAM** in partial fulfilment for the award of the degree of **Doctor of Medicine in Anaesthesiology** by the Tamilnadu Dr.M.G.R. Medical University, Chennai is a bonafide record of the work done by him in the Department of Anaesthesiology, Government Thanjavur medical College, during the academic year 2008-2011.

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**The Dean,**
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# DECLARATION

I, solemnly declare that the dissertation titled **"An evaluation of the postoperative analgesic efficacy and opioid sparing effect of Transversus abdominis plane block after caesarean section"** is a bonafide work done by me at Thanjavur Medical College Hospital, Thanjavur, during 2008 – 2010.

The dissertation is submitted to **"The Tamilnadu Dr. M.G.R. Medical University, Chennai",** Tamilnadu as a partial fulfillment for the requirement of **M.D** Degree examinations – Branch -X (Anaesthesiology) to be held in April 2011.

Place: Thanjavur
Date:

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## CONTENTS

# INTRODUCTION

Caesarean section is a major surgical procedure after which substantial postoperative discomfort and pain can be anticipated.[1] The provision of effective postoperative analgesia is important to facilitate early ambulation, infant care (including breast feeding, mother infant bonding) and prevention of postoperative morbidity.[1] The analgesic regimen needs to meet the goals of providing safe and effective analgesia with minimal side effects for the mother and her baby. A multimodal approach to postoperative analgesia after caesarean section is required.

Postoperative pain is often treated with systemic or neuraxial opioids. Although single-shot neuraxial analgesic technique using long-acting opioids, or patient-controlled epidural opioid administration, produce effective analgesia, they are associated with side effects, like nausea, vomiting, and pruritus, which reduces overall patient satisfaction.[1,2] Use of opioids and their subsequent side effects can be reduced or eliminated by regional anaesthesia with local anaesthetics. Direct blockade of the neural afferent supply of the abdominal wall, such as abdominal field blocks, ilioinguinal, and hypogastric nerve blocks provide significant postoperative analgesia in patients undergoing caesarean section.[3] However, the lack of

clearly defined anatomical landmarks make the abdominal wall blockade difficult in patients undergoing caesarean section. All these lead to the development in new post operative pain relief methods. An alternative, simple, reliable and effective regional analgesic technique is required.

An important component of pain experienced by patients after abdominal surgery is from the abdominal wall incision. The nerves that supply the anterior abdominal wall course through the neurofascial plane between internal oblique and transverses abdominis muscles.[8, 9] By injecting local anaesthesia into the transverses abdominis plane via petit triangle, it is possible to block the sensory nerves of the anterior abdominal wall, before they leave this plane and pierce the musculature to innervate the entire anterior abdominal wall on that side.[10, 11] TAP Block as a part of multimodal analgesic regimen would result in decreased opioid consumption and improved analgesia.[4-7] Thus the efficacy of Transversus abdominis plane (TAP) block in providing postoperative analgesia in caesarean section and its opioid sparing effect is evaluated in this study.

# AIM OF THE STUDY

The aim of the study was to evaluate the postoperative analgesic efficacy and opioid sparing effect of Transversus abdominis plane block after caesarean section.

# TRANSVERSUS ABDOMINIS PLANE (TAP) BLOCK:

This regional anaesthetic technique is a rapidly evolving subspecialty area. The TAP block allows sensory blockade of the lower abdominal wall via local anaesthetic deposition above the transversus abdominis muscle.

## History:

Abdominal field blocks have been used in anaesthesia for surgery involving the anterior abdominal wall for several decades. A technique involving multiple injections of local anaesthetic in the abdominal wall was used in the 1980s.[12] This technique was refined in TAP block using single needle puncture instead of multiple puncture, via the lumbar triangle of Petit.[10] Recently, ultrasound guided TAP block has been used with better results.[13-17]

## Anatomy:

Innervation of the anterolateral abdominal wall arises from the anterior rami of spinal nerves T7 to L1. Branches from the anterior rami include the intercostal nerves (T7-T11), the subcostal nerve (T12), and the

iliohypogastric and ilioinguinal nerves (L1).[18, 19, 20] These nerves give rise to lateral cutaneous and anterior cutaneous branches as they become more superficial. The intercostal nerves T7 to T11 exit the intercostal spaces and run in the neurovascular plane between the internal oblique and the transversus abdominis muscles. The subcostal nerve (T12) and the ilioinguinal and iliohypogastric nerves (L1) also travel in the plane between the transversus abdominis and internal oblique, innervating both of the muscles (fig.1) and (2). T7-T12 continues anteriorly from the transversus plane to pierce the rectus sheath and end as anterior cutaneous nerves.

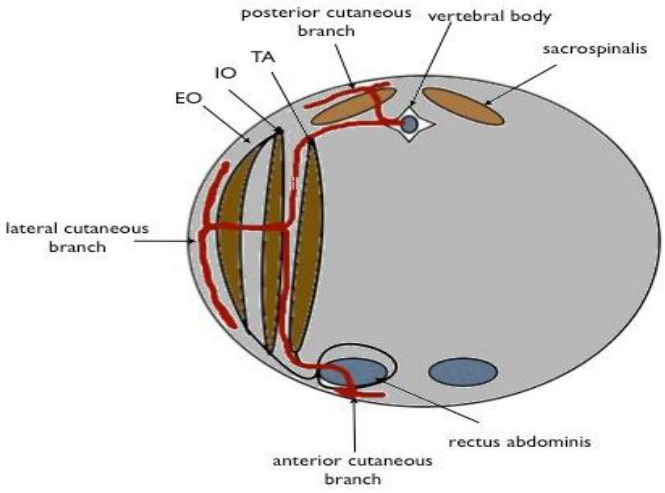


*Fig. 1. T7 to T12 spinal nerves pathway and branches in the abdominal wall*

The thoracic nerves, T7 to T12, provide motor innervation to pyramidalis and the rectus muscle. These nerves have cutaneous branches laterally in the abdomen. T7-T11 provides sensory innervation to the skin,

costal parts of diaphragm, related parietal pleura and the peritoneum. T7 gives sensory innervation at the epigastrium, T10 at the umbilicus, and L1 at the groin.[18, 19]

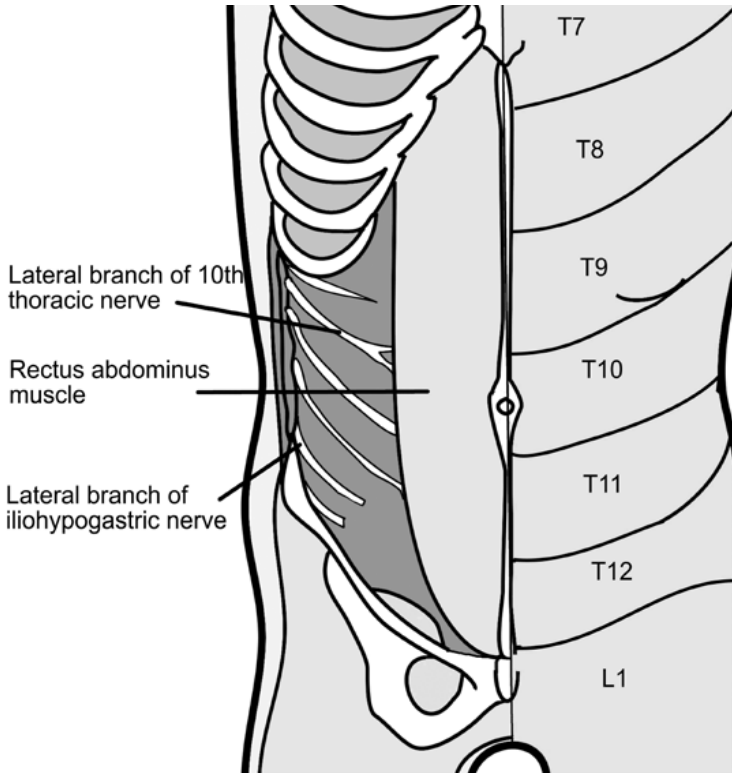


*Fig.2. Cutaneous nerve distribution and dermatomes of the abdominal wall.*

The layers of the antero-lateral abdominal wall supplied by T7-L1 thoracolumbar nerves from superficial to deep are as follows,

- Skin
- Subcutaneous tissues
- Rectus abdominis muscle
- Anterolateral muscles
    - -External oblique muscle
    - -Internal oblique muscle
    - -Transverses abdominis muscle
- Transversalis fascia and
- Parietal peritoneum.

**Indications:**

- Supplemental anaesthesia for any surgery involving the lower abdominal wall: bowel surgery, caesarean section, appendicectomy, hernia repair, umbilical surgery, gynaecological surgery.[23-28]
- When an epidural is contraindicated or refused.[29,30]
- Unilateral eg. Appendicectomy or bilateral where the incision crosses the midline. (Care should be taken not to exceed recommended safe doses of local anaesthetic agent with bilateral injections).

- Rescue analgesia on awake post-op patients who did not receive blocks prior to abdominal surgery.
- Prolonged duration of analgesic effect – TAP is relatively poorly vascularised therefore drug clearance may be slowed.
- In laparoscopic surgeries.
- Diagnosis of nerve entrapment syndromes following inguinal hernia surgery.

**Contraindications:**

**Absolute Contraindications:**

- Patient refusal
- Local anesthetic allergy
- Infection at the site of injection

**Relative Contraindications:**

- Coagulopathy or systemic anticoagulation
- Systemic infection (sepsis)

**Landmark Technique:**

The landmark for palpation is the 'triangle of Petit' which lies above the pelvic rim in the midaxillary line (fig.3). The inferior border of the

triangle is the iliac crest. The anterior border of the triangle is formed by the lateral edge of the external oblique muscle. The posterior border of the triangle is formed by the lateral edge of the latissimus dorsi muscle.[10, 11] The triangle is tender to deep palpation in conscious patients.

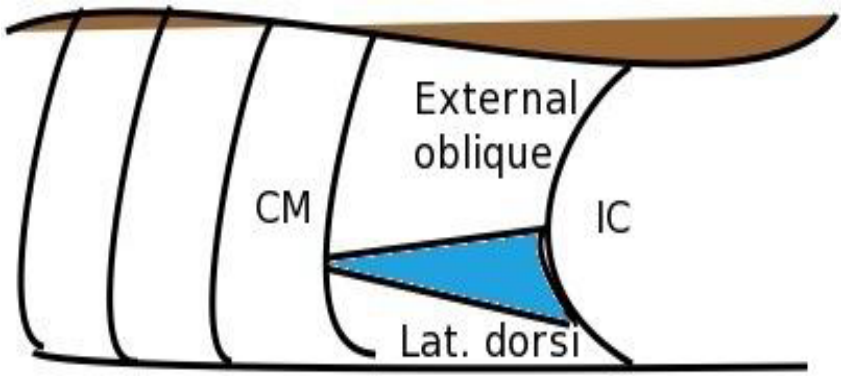


*Fig.3. Lumbar triangle of Petit between external oblique muscle and latissimus dorsi. CM: costal margin, IC: iliac crest.*

The puncture site is just above the iliac crest and just posterior to the midaxillary line within the triangle of petit. A 24G blunt tipped 50mm needle is inserted perpendicular to the skin, and a give or 'pop' is felt when the needle passes through the fascial extensions of the external oblique muscle. The needle tip is therefore between the fascial layers of the external and internal oblique. Further advancement with a second 'pop' indicates that the needle has advanced into the fascial plane above transverses abdominis and, after aspiration, 25-30ml of local anaesthetic is injected.[10, 11] There has

been some controversy about seeking one or two 'pops' during the landmark technique of TAP block. Use of a 'two pop' technique is generally advocated and is supported by the cadaveric and imaging studies published to date. [21,22]

The *triangle of Petit* can be difficult to palpate, especially in obese patients. Rafi suggests a needle insertion point 2.5cm behind the highest point of the iliac crest when the triangle is not clearly palpable.[10] Requesting the patient to lift his head and shoulders from the supine position will contract the abdominal muscles and can assist palpation of the triangle.

Many of our regional anaesthetic technique involve placing a needle in the intimate proximity of major neurological and/or vascular structures. One advantage of TAP block is the absence of major neurological or vascular structures in this area. Other advantages of TAP block are

- The landmark technique is simple and can be performed with ease.
- A single injection can achieve sensory block over a wide area of the abdominal wall.
- TAP block avoid the side effects associated with central neuraxial blockade, such as hypotension and wide motor blockade, and

complications such as epidural haematoma, epidural abscess and paraparesis

- TAP block is particularly useful for cases when an epidural is contraindicated or refused

**Complications:**

- Infection
- Hematoma
- Nerve injury
- Local anesthetic toxicity
- Peritoneal perforation
- Bowel and visceral perforation (rare).[32]

# PATHOPHYSIOLOGY OF PAIN

Effective postoperative pain control is an essential and humanitarian need of every surgical procedure. Inadequate pain control may result in increased morbidity and mortality, prolonged stay and increased hospital costs. [34,35]

**Definition of Pain:**

The Taxonomy Committee of International Association for the study of Pain (IASP) defines pain as "An unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage". [33] Postoperative pain is considered as a form of acute pain due to surgical trauma with an inflammatory reaction and initiation of an afferent neuronal barrage. It is a combined constellation of several unpleasant sensory, emotional and mental experiences precipitated by the surgical trauma and associated with autonomic, endocrine, metabolic, physiological and behavioral responses. [38]

**Physiology of pain:**

The spinal cord is the main part of the body's central nervous system that conveys signal from the brain to the nerves throughout the body. Nerves coming from and leading to all parts of the body enter and exit the spinal

cord along its entire length. There are 31 pairs of spinal nerves that exit the spinal cord through openings between the vertebrae. The point at which the nerve exits the spinal is called the nerve root, and where it branches into many smaller nerves that control different part of the body is called peripheral nerves. The peripheral nerves include both motor (efferent) and sensory (afferent) nerves. Sensory nerves are nerves that receive and transmit sensory stimuli to Substantia gelatinosa; Motor nerves lead to the muscles and stimulate movement.

**Various mechanisms are:**

**Nociception** refers to the processing of a noxious stimulus resulting in the perception of pain by the brain.[36] The components of nociception include transduction, transmission, modulation and perception (fig.4). Hyper responsiveness (allodynia) is a hallmark feature of both acute and chronic pathologic pain. This is a result of changes in the nervous system response (neuroplasticity) at peripheral and central locations (fig.4).

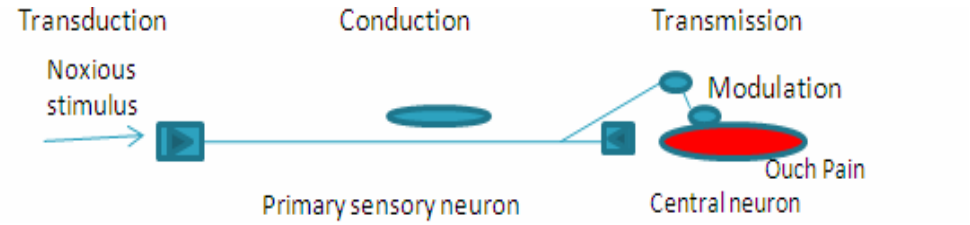


*Fig. 4: Process of Nociception*

**Peripheral sensitization** occurs when tissue inflammation leads to the release of a complex array of chemical mediators, resulting in reduced nociceptor thresholds. This causes an increased response to painful stimuli (primary hyperalgesia).

**Central sensitization** refers the responses in the CNS. Central sensitization is primarily a physiological process and only if there is continual firing of C-nociceptors for longer time will these processes leads to more chronic pain syndromes [37] (fig.5).

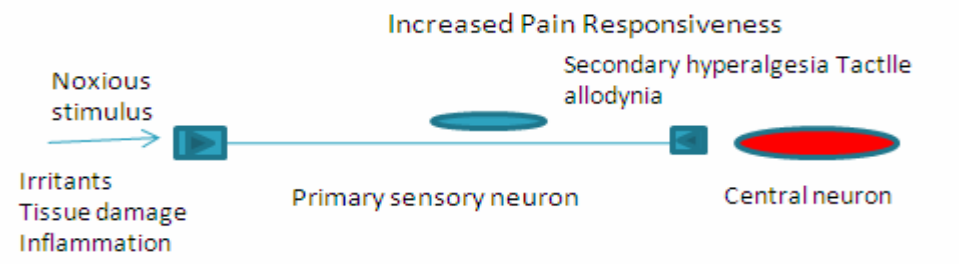


*Fig. 5: Process of Central Sensitization*

## Pathways of pain:

Pain is conducted along three neuron pathway that transmits the noxious stimuli from periphery to cerebral cortex.

- A first order neuron (cell body in dorsal root ganglion) transmits pain from a peripheral receptor to the dorsal horn of the spinal cord

- A second-order neuron located in the dorsal horn of the spinal cord sends axons which crosses the midline to ascend in the spinothalamic tract to the thalamus.
- A third-order neuron in the Thalamus projects its fibers to the post central gyrus (via the internal capsule).

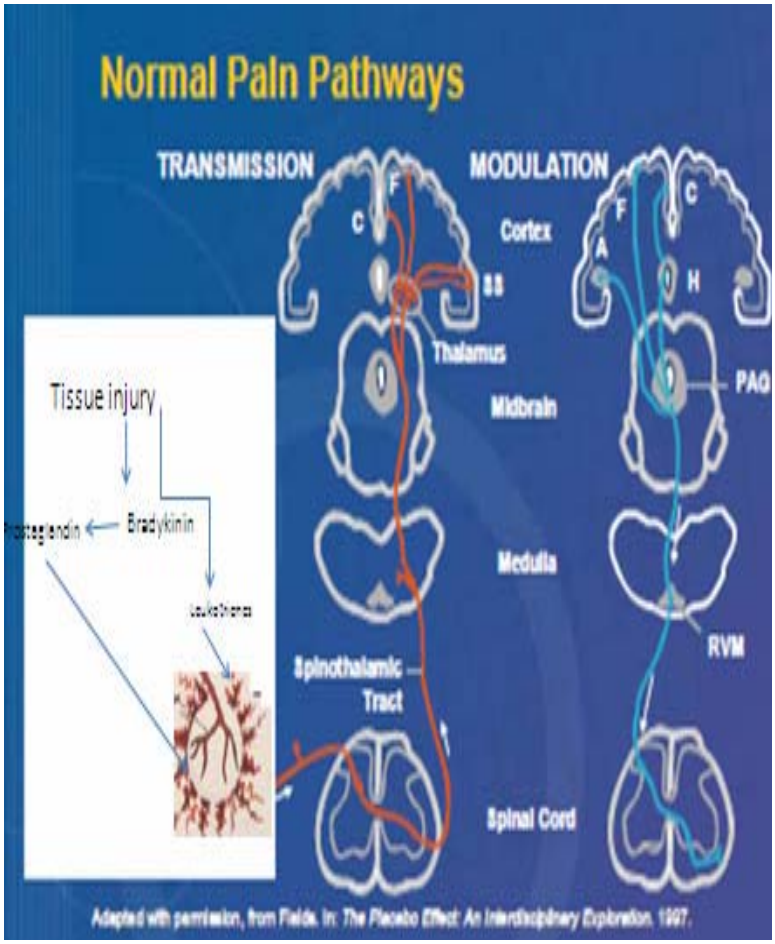


*Fig. 6: Normal Pathways of Pain*

## Physiological responses to pain:

The state of pain following a surgical procedure is a combination of pain as a specific sensation due to nocioceptive response to tissue damage and pain as a suffering (psychological). It has been found that uncontrolled pain in post operative period produced physiological effects like altered stress response to surgery, increased catecholamines, higher incidence of pulmonary complications, deep vein thrombosis and ultimately increasing the morbidity.[38-40]

Pain associated with thoracic and upper abdominal surgery can cause significant postoperative respiratory dysfunction. Pain causes an increase in muscle tone around the site of injury. This "muscle splinting", coupled with voluntary reductions in respiratory muscle excursions, causes reduction in lung volumes (tidal volume, vital capacity and functional residual capacity), regional lung collapse (atelectasis) and reduced alveolar ventilation, all of which ultimately result in hypoxemia and hypercapnia. These respiratory changes also result in a reduced ability to cough, retention of secretions and increased risk of chest infections. Adequate perioperative pain relief, coupled with breathing exercises, can reverse these adverse respiratory effects.[39]

Increased sympathetic activity associated with pain also results in decreased gastrointestinal motility (gastric stasis and paralytic ileus), increased intestinal secretions and increased smooth muscle sphincter tone. Pain can cause increased motility of the urethra and bladder and consequent difficulty with micturition.

Postoperative pain can be divided into acute pain and chronic pain.[41] Acute pain is experienced immediately after surgery (up to 7 days) and pain which lasts more than 3 months after the injury is considered to be chronic pain.[44-46] Acute and chronic pain can arise from cutaneous, deep somatic or visceral structures.Acute pain is of two types:

*1. Somatic Pain:*

a. Superficial somatic pain - arising from skin, subcutaneous tissue, mucous membrane. It is sharp pricking and well localized.

b. Deep somatic pain - arises from muscles, tendons, joint and bones. It has dull aching quality and less well localized. Both the intensity and duration of pain affects the degree of localization.

*2. Visceral Pain:*

It is due to disease or abnormal function of an internal organ or its covering which is poorly localized, dull and vague, may be colicky, cramping, or squeezing

## ASSESSMENT OF PAIN

It is vital element in effective postoperative pain management. Specific pain assessment scales are used to quantify pain.[42,43] The patient's own report is the most useful tool. The intensity of pain should therefore be assessed as far as possible by the patient as long as he/she is able to communicate and express what pain feels like.

A number of different patient self-assessment scales are available

**Visual analogue scale (VAS) :**

VAS is the most common used method to assess pain which was first described in 1966. It is a very simple scale, used in pain research. It consists of a 10 cm line with two anchor points of ‘no pain’ and ‘worst pain imaginable’ which is self assessed by patient (fig.7), The position of the mark on the line measures how much pain the subject experiences.

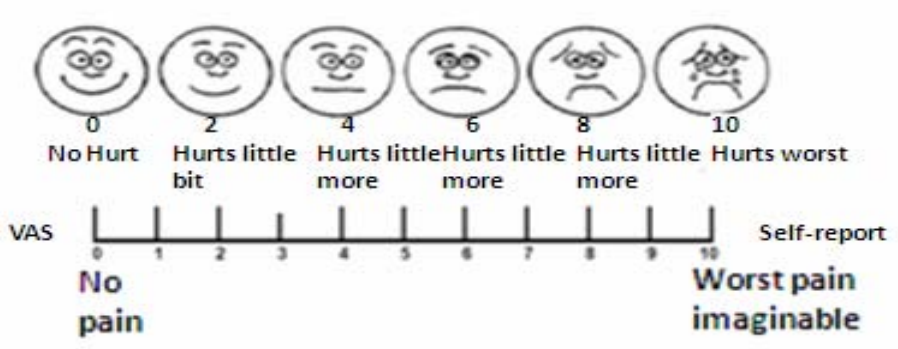


*Fig.7. Wong-Baker Faces Pain Rating Scale and Visual Analogue Scale*

**Facial expressions**:

A pictogram of six faces with different expressions from smiling or happy through to tearful (fig.7). This scale is suitable for patients where communication is a problem, such as children, elderly patients, confused patients or patients who do not speak the local language.

**Numerical rating scale (NRS):**

It is similar to the visual analogue scale with the two anchors of 'no pain' and 'worst pain as from 0 to 10 (making an 11-point scale), assessed by patient (Fig. 8).

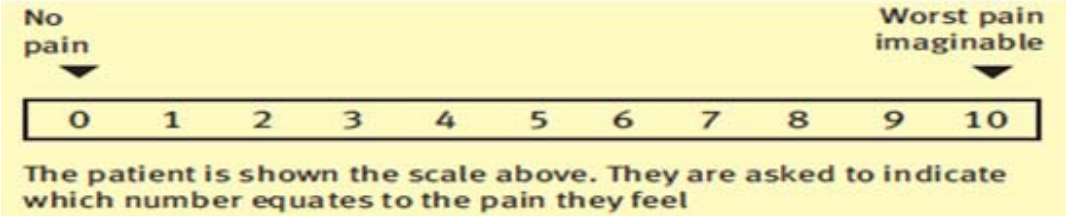


*Fig. 8: Numerical Pain Scale*

**Verbal rating scale (VRS):**

It is usually has four points: no pain, mild pain, moderate pain, and severe pain. It is easy to use and can be used in the mildly cognitively impaired, but it is insensitive to small changes in pain intensity.

The preoperative personality assessment is also helpful in assessing the patient's Psychological background and his psycho reactions to surgery

and the pain that follows it. The VRS and NRS are the most frequently used assessment tools in the clinical setting while the VAS scale is primarily used as a research tool.

## METHODS OF ACHIEVING PAIN RELIEF:

*"Pain relief has always been bought at a Price" – Bromage*

There are number of factors which contribute for effective postoperative pain management such as a structured acute management team, patient education, regular staff training, use of balanced analgesia, regular pain assessment tools and adjustment of strategies to meet the needs of special patient groups.[46] The onset of the 21st century is an incredibly exciting time in pain biology. Information from recent studies in basic pain research is virtually exploding and has revealed numerous novel targets for the advent of new pain therapies.

Following any surgery, the pain after the tissue damage is rather self limiting. It persists at the most for the first 24 hrs and subsides in 4 days time.[44] The post operative pain is dull in nature aggravated by mobility, relieved by rest to that part. The acute pain of surgery is strongly

accompanied by emotive elements of fear, anxiety, and depression of previous experience of pain.

The goals of effective and appropriate pain management are to:

- Facilitate rapid recovery and return to full function.
- Reduce morbidity.
- Improve quality of life for the patient.
- Allow early discharge from hospital.

Methods adopted for providing post operative pain relief include: [45-50]

**Pharmacological methods: -**

i. Balanced (multimodal) analgesia

ii. Opioids

iii. Non-opioids

iv. Adjuvants

v. Patient controlled analgesia

vi. Regional analgesia

Continuous central Neuraxial Blockade (CCNB)

Continuous Peripheral Nerve Blockade (CPNB)

Infiltration blocks

**II. Non pharmacological methods**: - This includes

A. Transcutaneous electrical Nerve Stimulation (TENS)

B. Acupuncture

C. Cryotherapy

D. Heat Therapy

**Pharmacological methods:**

***Balanced (multimodal) analgesia:*** uses two or more analgesic agents and or technique that act by different mechanisms to achieve a superior analgesic effect without increasing adverse events compared with increased doses of single agents. Balanced analgesia is therefore the method of choice wherever possible.

***Opioids*** can be administrated by various routes, each having its own advantages and disadvantages:-

*Oral*: This is unsuitable for post operative patients due to erratic absorption of the drugs. Some opioids like Buprenorphine are administered by sublingual route.

*Intramuscular:* The largest and commonest mode of administration with the attendant drawback of erratic absorption, drug over dosage and frequent occurrence of respiratory depression.

*Intravenous*: This has short duration, and a rapid onset of action. Tolerance and addiction are common.

*Neuraxial:* This route has gained popularity because of the longer duration of segmental analgesia with smaller doses. The cardiovascular and respiratory complications are less if used judiciously.

**Non opioids and Adjuvants**:

Non opioids include analgesics like paracetamol, aspirin to more potent ones like Nonsteroidal anti-inflammatory drugs.[48] Adjuvants include ketamine and clonidine. Clonidine can be administered orally, intravenously or perineurally in combination with local anaesthetics. However, the side effects could be significant. The most important ones are hypotension and sedation. Ketamine can be administered via oral, intramuscular or intravenous routes. It has also significant side effects.

**Regional analgesia:**

Central neuraxial block involves either intermittent or continuous administration of local anaesthetics in order to interrupt sensory

transmission.[49] The important draw back of this technique is the accompanying motor and sympathetic blockade which can increase the incidence of post Operative Complications. Extradural block offers complete pain relief, permits effective coughing & better ventilation. But the total spinal, accidental dural punctures are more with inexperience hands.

Peripheral nerve blocks are being increasingly used since they may provide more selective but still excellent postoperative analgesia with reduced need for opioids over an extended period. Peripheral nerve blocks (PNBs) avoid the side effects associated with central neuraxial blockade, such as hypotension and wide motor blockade with reduced mobility and proprioception, and complications such as epidural haematoma, epidural abscess and paraparesis.

**Patient Controlled Analgesia pump or PCA:**

It is a special computerized infusion pump that holds pain medication and delivers it through an intravenous line (IV). The pump enables the patient to give himself pain medication, and to control the amount of medication received for pain relief.[50]

## PHARMOLOGY OF ROPIVACAINE

- Ropivacaine is a long acting local anaesthetic belonging to amino amide group.[51]
- Injection form is a sterile isotonic solution that contains enantiomerically pure drug substance containing sodium chloride for isotonicity and water for injection.
- Comes as preservative free and is available in 0.2%, 0.5%, 0.75% and 1.0% concentrations, (0.2%=2mg/ml, 1.0%=10mg/ml).

**Physiochemical properties:**

- Chemically described as S-(-)-1-propyl-2',6'-pipecoloxylidide hydrochloride monohydrate

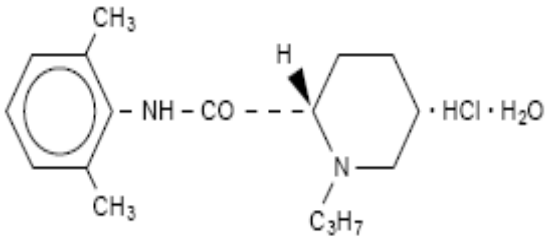


*Fig. 9. Chemical structure of Ropivacaine*

- Molecular wt-274
- Pka - 8.07, Ph - 7.4
- Protein binding - 94%

- Partition coefficient (lipid solubility) - 8.7 (Bupivacaine- 28) thus it blocks 'A' fibres more slowly and thus less motor blockade than bupivacaine.
- T1/2 - 111 minutes, clearance -10.3 L/minutes.
- Moderate onset and long acting.

***Pharmacodynamic properties:***

- Ropivacaine is a long-acting amide-type local anaesthetic developed as a pure S-enantiomer.
- Ropivacaine causes reversible blockade of impulse propagation along nerve fibres by preventing the inward movement of sodium ions through the cell membrane of the nerve fibres.
- Ropivacaine has both anaesthetic and analgesic effects. At higher doses it produces surgical anaesthesia, while at lower doses it produces sensory block (analgesia) with limited and non progressive motor block.
- The duration and intensity of ropivacaine block are not improved by the addition of adrenaline
- Local anaesthetics may have similar effects on other excitable membranes, e.g. in the brain and myocardium. If excessive amounts

of the medicine reach the systemic circulation rapidly, symptoms and signs of toxicity may appear, from the central nervous and cardiovascular systems.

- Hypotension and bradycardia are uncommon after caudal epidural block in children.

***Pharmacokinetic properties:***

**Absorption:**

The plasma concentration of ropivacaine depends upon the dose, the route of administration and the vascularity of the injection site. Ropivacaine follows linear pharmacokinetics and the maximum plasma concentration is proportional to the dose.

**Distribution:**

After intravascular infusion, ropivacaine has a steady state volume of distribution of 41±7 liters. It is 94% protein bound, mainly to a1-acid glycoprotein. Ropivacaine readily crosses the placenta.

**Metabolism:**

Ropivacaine is extensively metabolized in the liver, predominantly by aromatic hydroxylation mediated by cytochrome P4501A to 3-hydroxy

ropivacaine, approximately 37% of the total dose is excreted in the urine as both free and conjugated 3-hydroxy ropivacaine. Low concentrations of 3-hydroxy ropivacaine have been found in the plasma. An additional metabolite, 2-hydroxymethyl- ropivacaine, has been identified but not quantified in the urine. N-de-alkylated metabolite of ropivacaine and 3-OH-ropivacaine are the major metabolites excreted in the urine during epidural infusion.

**Elimination:**

The kidney is the main excretory organ for most ropivacaine metabolites. In total, 86% of the ropivacaine dose is excreted in the urine after intravenous administration of which only 1% relates to unchanged drug.

**Dosage (TAP Block):**

- 1.5mg/kg Ropivacaine 0.375% (maximal dose of 150mg) per side.
- Upper limit of safe dosage in adult is 3mg/kg body weight upto 275mg.

Ropivacaine should only be administered in incremental doses and is not recommended for emergency, where a fast onset of surgical anesthesia is necessary.

**Indications:**

***Surgical anaesthesia:***

- Epidural block for surgery, including Caesarean section.[52]
- Minor nerve block and infiltration anaesthesia
- Major nerve block

***Acute pain management:***

- Continuous epidural infusion or intermittent bolus administration e.g. postoperative or labour pain
- Minor nerve block and infiltration analgesia

***Acute pain management in paediatrics:***

- Caudal epidural block
- Peripheral nerve block for intra and postoperative pain management

**Contraindications:**

- Ropivacaine solutions are contra-indicated in patients with known hypersensitivity to local anaesthetic of the amide-type.
- Intravenous regional anaesthesia (Bier's block).
- Obstetric Para cervical anaesthesia.

- Local anesthetics are contra-indicated for epidural and spinal anaesthesia in patients with uncorrected hypotension.
- Local anaesthetic techniques must not be used when there is inflammation and/or sepsis in the region of the proposed injection and/or in the presence of septicemia.

**Adverse effects:**

Reactions to ropivacaine may be associated with excessive plasma levels, which may be due to overdosage, unintentional intravascular injection or slow metabolic degradation. The mean doses at which CNS symptoms of toxicity begin to occur in human beings are 4.3 and 0.6 μg/ ml of total and free plasma concentrations respectively. When prolonged blocks are used, either through continuous infusion or through repeated bolus administration, the risks of reaching a toxic plasma concentration or inducing local neural injury are increased. Ropivacaine has also not been approved for intraarticular infusions. There have been reports of chondrolysis in patients receiving intraarticular local anaesthetic infusions.

**The various possible side effects include:**

- Cardiovascular System - vasovagal reaction, syncope, postural hypotension, nonspecific ECG abnormalities.[54]
- Gastrointestinal System - fecal incontinence, tenesmus, neonatal vomiting.
- General and Other Disorders - hypothermia, malaise, asthenia.
- Hearing and Vestibular - tinnitus, hearing abnormalities.
- Liver and Biliary System – jaundice Metabolic Disorders – hypomagnesemia.
- Musculoskeletal System – myalgia.
- Nervous System - tremor, Horner's syndrome, paresis, dyskinesia, neuropathy, vertigo, coma, convulsion, hypokinesia, hypotonia, ptosis, stupor, vision abnormalities. Due to a depressant effect of ropivacaine on medulla, excitatory stage of CNS toxicity might not occur.[53]
- Psychiatric Disorders - agitation, confusion, somnolence, nervousness, amnesia, hallucination, emotional liability, insomnia, nightmares.
- Skin Disorders - rash, urticaria.
- Urinary System Disorders- urinary incontinence, micturition disorder.
- Vascular - deep vein thrombosis, phlebitis, pulmonary embolism.

**WARNINGS:**

In performing ropivacaine blocks, unintended intravenous injection is possible and may result in cardiac arrest. Ropivacaine should be administered in incremental doses and not to be injected rapidly in large doses.

It is not recommended for emergency situations, where a fast onset of surgical anaesthesia is necessary. Historically, pregnant patients were reported to have high risk for cardiac arrhythmias, cardiac/circulatory arrest and death when 0.75% bupivacaine (another member of the amide class of anaesthetics) was inadvertently rapidly injected intravenously.

It is essential that aspiration for blood or cerebrospinal fluid (where applicable), be done prior to injecting any local anaesthetic for both the bolus dose and all subsequent doses, to avoid intravascular injection. However a negative aspiration does not ensure against an intravascular injection.

## REVIEW OF LITERATURE

The lateral abdominal wall contains three muscle layers including the external oblique, the internal oblique, and the transversus abdominis muscles and their associated fascial sheaths. The lower thoracic and upper lumbar nerves provide sensory innervation of the skin, muscles, and parietal peritoneum of the anterior abdominal wall. These nerves course in a plane between the transversus abdominis and internal oblique muscles. Given the anatomic localization of these nerves, sensory blockade of the anterolateral abdominal wall was first described by *Rafi* in 2001.[10]

***McDonnell et al,* 2008** [4] conducted a double blind randomized case-control study to evaluate the analgesic efficacy of TAP block in fifty women undergoing elective cesarean delivery with ropivacaine (n=25) versus placebo (n=25), in addition to standard postoperative analgesia comprising patient-controlled IV morphine analgesia and regular diclofenac and acetaminophen. All patients received a standard spinal anesthetic, and at the end of surgery, a bilateral TAP block was performed using 1.5 mg/kg ropivacaine (to a maximal dose of 150 mg) or saline on each side. TAP block with ropivacaine compared with placebo reduced postoperative visual

analog scale pain scores. Mean (±SD) total morphine requirements in the first 48 postoperative hours were also reduced (66±26 vs 18±14 mg, P<0.001), as was the 12-h interval morphine consumption up to 36 h postoperatively. They concluded that TAP block, as a component of a multimodal analgesic regimen, provided superior analgesia when compared with placebo block up to 48 postoperative hours after elective cesarean delivery.

***D. Belavy et al,* 2009**[7] conducted a randomized double blind, placebo-control trial to evaluate the efficacy of ultrasound guided TAP block for postoperative analgesia after cesarean deliveries in fifty women, received bilateral ultrasound guided TAP blocks with either ropivacaine 0.5% or saline. Forty-seven participants completed the trial, 23 in the active group and 24 in the placebo group. Total morphine use in 24 h was reduced in the active group (median 18.0 mg) compared with the placebo group (median 31.5 mg, P<0.05). The active group reported improved satisfaction with their pain relief measured by visual analogue scale compared with the placebo group (median 96 vs 77 mm, p=0.008). They concluded that ultrasound guided TAP block reduces morphine requirements after Caesarean delivery when used as a component of a multimodal analgesic regimen.

***McDonnell et al,* 2007** [11] conducted a randomized double blind case-control study in thirty-two adults undergoing large bowel resection via a midline abdominal incision to receive standard care, including patient controlled morphine analgesia and regular non-steroidal anti-inflammatory drugs and acetaminophen (n=16), or to undergo TAP block (n=16) in addition to standard care (n=16). After induction of anesthesia, 20 ml of 0.375% levobupivacaine was deposited into the transversus abdominis neuro-fascial plane via the bilateral lumbar triangles of Petit. TAP block reduced visual analog scale pain scores (TAP versus control, mean ± SD) on emergence (1±1.4 vs 6.6±2.8, $P<0.05$), and at all postoperative time points, including at 24 h (1.7±1.7 vs 3.1±1.5, $P<0.05$). Morphine requirements in the first 24 postoperative hours were also reduced (21.9±8.9 mg vs 80.4 ±19.2 mg, $P<0.05$). They concluded that TAP block provided highly effective postoperative analgesia in the first 24 postoperative hours after major abdominal surgery.

***Carney J et al,* 2008** [23] conducted a randomized double blind case-control clinical trial in 50 females undergoing elective TAH to undergo bilateral TAPB with ropivacaine 1.5mg/kg to a maximum of 150mg before

surgical incision (n=24) versus placebo (n=26) in addition to standard post operative analgesia comprising patient-controlled IV morphine, diclofenac & acetaminophen. The results of the study showed reduced VAS pain score at rest and on movement, reduced mean total morphine requirements in the first 48 postoperative hours -55mg vs 27mg, $p<0.001$ (primary outcome measure). They concluded that TAP block, as a component of a multimodal analgesic regimen, provided superior analgesia when compared to placebo block up to 48 postoperative hours after elective total abdominal hysterectomy.

***G. Niraj et al,* 2009** [26] evaluated the analgesic efficacy of TAP block in patients undergoing open appendicectomy in a randomized controlled double-blinded clinical trial. Fifty-two adult patients undergoing open appendicectomy were randomized to undergo standard care (n=26) or to undergo a right-sided TAP block with bupivacaine (n=26). In addition, all patients received patient-controlled i.v. morphine analgesia, regular acetaminophen, and non-steroidal anti-inflammatory drug, as required, in the postoperative period. All patients received standard anaesthetic, and after induction of anaesthesia, the TAP group received an ultrasound-guided unilateral TAP block. Ultrasound-guided TAP block significantly reduced

postoperative morphine consumption in the first 24 h [mean (SD) 28 (18) vs 50 (19) mg, P<0.002]. Postoperative visual analogue scale pain scores were also reduced in the TAP block group soon after surgery [median (IQR) 4.5 (3–5.3) vs 8.5 (7.5–10), P<0.001] and at 24 h [5.2 (4–6.2) vs 8 (7–8.5), P<0.001. Ultrasound-guided TAP block holds considerable promise as a part of a balanced postoperative analgesic regimen for patients undergoing open appendicectomy.

***A. A. El-Dawlatly et al,* 2009** [27] conducted a prospective, randomized, and double-blinded study was designed to describe a method of ultrasound-guided TAP block and to evaluate the intra- and postoperative analgesic efficacy in patients undergoing laparoscopic cholecystectomy under general anaesthesia with or without TAP block. Forty-two patients undergoing laparoscopic cholecystectomy were randomized to receive standard general anaesthetic either with (Group A, n=21) or without TAP block (Group B, n=21). Ultrasound-guided bilateral TAP block was performed with a high frequent linear ultrasound probe and an in-plane needle guidance technique with 15 ml bupivacaine 5 mg/ml on each side. Intraoperative use of sufentanil and postoperative demand of morphine using a patient-controlled analgesia device were recorded. Patients in Group A received significantly

more intraoperative sufentanil and postoperative morphine compared with those in Group B [mean (SD) 8.6 (3.5) vs 23.0 (4.8) mg, P<0.01, and 10.5 (7.7) vs 22.8 (4.3) mg, P<0.05]. They concluded that Ultrasonographic guidance enables exact placement of the local anaesthetic for TAP blocks. In patients undergoing laparoscopic cholecystectomy under standard general anaesthetic, ultrasound-guided TAP block substantially reduced the perioperative opioid consumption.

***T. M. N. Tran et al,* 2009** [31] conducted an anatomical study with dye injection into the TAP and subsequent cadaver dissections was to establish the likely spread of local anaesthesia in vivo and the segmental nerve involvement resulting from ultrasound-guided TAP block. 16 hemi-abdominal walls were successfully injected and dissected. The lower thoracic nerves (T10–T12) and first lumbar nerve (L1) were found emerging from posterior to anterior between the costal margin and the iliac crest. Segmental nerves T10, T11, T12, and L1 were involved in the dye in 50%, 100%, 100%, and 93% of cases, respectively. They concluded that ultrasound-guided TAP injection cephalad to the iliac crest is likely to involve the T10–L1 nerve roots, and implies that the technique may be limited to use in lower abdominal surgery.

# MATERIALS AND METHODS

**Study Type:** Interventional

**Study design**:

Prospective, randomized, double blinded, case control study.

**Study population**:

50 female patients who underwent caesarean section by pfannenstiel incision at GOVT. RAJA MIRASUDAR HOSPITAL**,** which is affiliated to THANJAVUR MEDICAL COLLEGE, were taken up for study.

**Case definition**

Female patients of age group 18-35 with ASA I and II undergoing cesarean section by pfannenstiel incision

**Groups**

Group(R): Ropivacaine group – 25 patients

Group (N): Normal saline group – 25 patients

**Outcome Measures for this Clinical Trial**

**Primary Measures:**

- To evaluate efficacy and safety of TAP Block

**Secondary Measures:**

- To evaluate pain scores at 1, 2, 3, 4, 5, 6, 12, 18, and 24 hrs after surgery
- To evaluate the time it takes for a woman to ask for the first analgesic medication after the surgery
- To evaluate postoperative total opioid consumption

**Eligibility:**

- Ages: Between 18 and 35 years
- Gender: Female

**Inclusion Criteria:**

- ASA physical status class I and II
- Age between 18 and 35 years

**Exclusion Criteria**:

- Patient refusal
- Patient with known reaction to local anaesthetics
- History of bleeding diathesis
- Known psychiatric illness,
- Patients on chronic analgesics.

**Probability sampling:**

50 lots were randomized (25 in each group) from the people who were willing to take part in the study. All the patients stand an equal chance of getting into any group. All the patients were aware of the study and informed consent was obtained

**Sample size:**

Ropivacaine (R) group - 25 patients

Normal saline (N) group - 25 patients

**Data collection**:

Age, weight, Duration of surgery, VISUAL ANALOGUE SCALE in 1, 2, 3, 4, 5, 6, 12, 18 and 24 hrs, HR, Systolic BP, Diastolic BP, time for first demand of analgesic, total dose of rescue analgesia.

**Materials:**

- 23 G Quinckes spinal needle, 5% heavy lignocaine
- 18 G Tuohy needle, 0.75% Ropivacaine, sterile normal saline
- 2 ml and 20 ml syringes
- Swabs, swab holding forceps and sterile towel

**Methods:**

After obtaining approval by the Hospital Ethics Committee, and written informed patient consent, we studied 50 ASA physical status I–II patients scheduled for caesarean section by pfannenstiel incision, in a prospective, randomized, double-blind, controlled clinical trial. In the preoperative waiting room detailed history and physical examination was done. Baselines data like pulse rate, blood pressure, respiratory rate, and basic investigations were collected. The study group and control group were explained about the procedures (Both SAB and TAP Block) and postoperative follow up pattern. The VAS was explained as 0-10 cm scale reading and patient was asked to tell the number.

Patients were randomly allocated to undergo TAP block (n=25) with 20 ml of 0.375% ropivacaine (to a maximum dose of 150 mg) per side or TAP block with saline 0.9% (control, n=25). The patients, their investigator, and staff providing postoperative care were blinded to group assignment. Common to both groups an 18G IV Cannula was secured, preloading done with 1000ml of crystalloid. Under asepsis, SAB performed with 5% Lignocaine using 23G Quincke's spinal needle to all the patients in both groups.

Under asepsis TAP Block was performed bilaterally by an anaesthesiologist who was blinded to the drug, a double 'pop off' technique was used to locate the Transversus abdominis plane. Group (R) received 20 ml of 0.375% Ropivacaine on each side and Group (N) received 20 ml of normal saline on each side. After observing closely for signs of toxicity patients were shifted to post operative ward.

Standard postoperative analgesic regimen: Inj. Diclofenac sodium 75mg i.m. was given to all patients after shifting to the ward, second dose repeated 12 hours later. Rescue analgesia: Inj. Tramadol 100mg i.m. was used as first rescue analgesia either on demand or when the VAS score was $\geq$ 3. If the patient asks for second/subsequent rescue dose between 3 and 6 hours Tramadol 50mg i.m. was given. If the patient asks for rescue dose within 3 hours Inj. Tramadol 50mg was withheld to allow for the peak action of first dose. If the patient asks for rescue dose after 6 hours Inj. Tramadol 100mg i.m. was repeated.

The presence and severity of pain was assessed using visual analogue scale (VAS 0 =no pain and 10 =worst pain imaginable) at 1, 2, 3, 4, 5, 6, 12, 18, and 24 hours by an investigator blinded to group allocation. Vitals (HR, SBP, DBP) was also recorded upto 6 hours in the immediate post operative period after TAP block, and time for first demand of tramadol, and total dose of tramadol as rescue analgesia given to the patient was noted.

# OBSERVATIONS AND RESULTS

In our study we have evaluated the analgesic efficacy and opioid sparing effect of Transversus abdominis plane block in caesarean section for postoperative pain relief, the observation and results were analyzed, using two sample student's t-test and chi square test, the results were considered statistically significant when "p" value was $\leq 0.05$.

The patients included in this study were divided into two groups consisting of 25 patients each. Group R (n=25) received ROPIVACAINE

Group N (n=25) received NORMAL SALINE

Groups were comparable in terms of age, weight and duration of surgery. In all patients, the triangle of Petit was located easily on palpation, the transversus abdominis neurofascial plane was localized after one to two attempts, and the block performed without complication.

In order to ascertain the significance of demographic features, sample data were analysed using chi square test, continuous variables are analysed using two sample student t-test.

***Table 1: Age distribution***

| Drug groups<br>Age groups | R | N |
|---|---|---|
| 20-25 | 14 | 11 |
| 25-30 | 9 | 11 |
| 30-35 | 2 | 3 |
| Total | 25 | 25 |

***Table 2: Age in years***

| Group | N | Mean | Std.deviation | Std.Error | p value |
|---|---|---|---|---|---|
| R | 25 | 25.4000 | 3.16228 | .63246 | |
| N | 25 | 26.4400 | 3.53648 | .70730 | >0.05 |

The two groups were similar with respect to age distribution and difference was statistically insignificant (p >0.05).

***Table 3:*** **Weight in kilogram**

| Group | N | Mean | Std.deviation | Std.Error | p value |
|---|---|---|---|---|---|
| R | 25 | 55.8000 | 3.74166 | .74833 | |
| N | 25 | 56.8800 | 3.90854 | .78171 | >0.05 |

The two groups are comparable with respect to weight and difference is statistically insignificant (p >0.05).

***Table 4: Duration of surgery in minutes***

| Group | N | Mean | Std.deviation | Std.Error | p value |
|---|---|---|---|---|---|
| R | 25 | 37.3200 | 4.44147 | .88829 | |
| N | 25 | 37.8400 | 4.33667 | .86733 | >0.05 |

The two groups were comparable with respect to duration of surgery and difference was statistically insignificant (p >0.05).

Thus the groups were comparable with respect to Age, Weight, Duration of surgery, but the differences were statistically insignificant (p value > 0.05), so that the difference proved in other variables has least possibility of occurring by chance.

***Table 5: VAS pain score:***

| VAS Score | Drug groups | | P value |
|---|---|---|---|
| | R | N | |
| 1 hr | 0 | 1.28±1.10 | >0.05 |
| 2 hr | 0 | 5.20±0.52 | <0.05 |
| 3 hr | 0 | 3.64±0.38 | <0.05 |
| 4 hr | 0 | 4.92±0.20 | <0.05 |
| 5 hr | 1.52±0.93 | 5.04±0.47 | <0.05 |
| 6 hr | 1.92±0.91 | 4.8±0.35 | <0.05 |
| 12 hr | 2.24±0.62 | 4.68±0.54 | <0.05 |
| 18 hr | 2.20±0.62 | 4.48±0.51 | <0.05 |
| 24 hr | 2.00 | 4.00±0.64 | <0.05 |

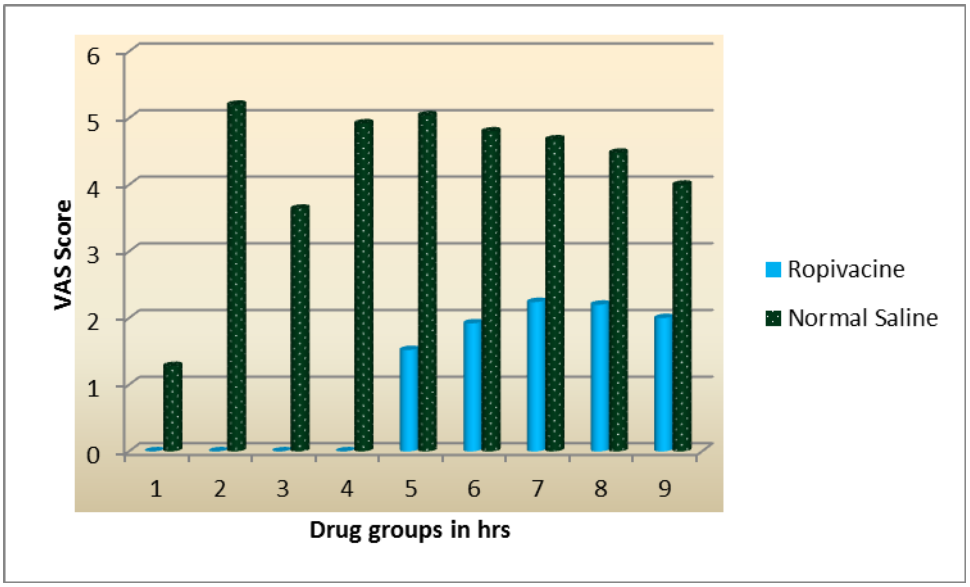


***Fig.9. Postoperative vas pain scores***

Postoperative VAS pain scores were significantly reduced in Ropivacaine group in all the time intervals when compared to Normal saline group as shown in table.5. and fig.9.

***Table 6: Heart rate in beats/minute***

| Time | Group( R ) | Group( N ) | p value |
|---|---|---|---|
| 1 hr | 100.44±5.21 | 102.88±5.74 | >0.05 |
| 2 hr | 97.08±4.91 | 100.08±6.22 | >0.05 |
| 3 hr | 95.68±4.36 | 99.96±5.61 | <0.05 |
| 4 hr | 93.98±5.10 | 98.12±4.84 | <0.05 |
| 5 hr | 92.68±4.51 | 97.24±4.67 | <0.05 |
| 6 hr | 91.80±3.44 | 92.28±7.73 | >0.05 |

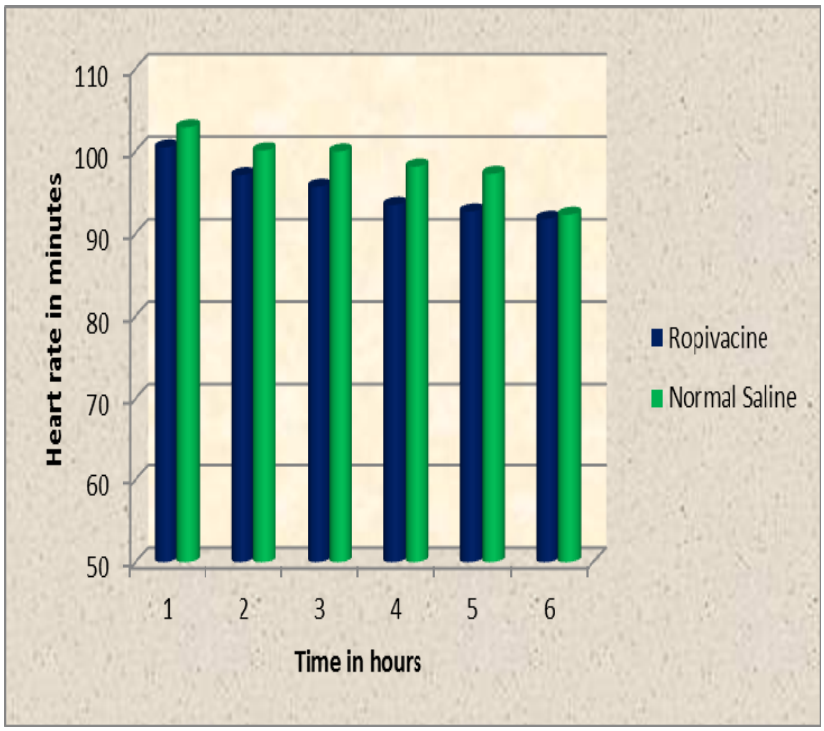


***Fig.10. Bar chart for postoperative HR in minutes***

Ropivacaine group has decreased HR in all the intervals compared to Normal saline group with statistical significance ($p < 0.05$)

***Table 7: Blood pressure in mmHg***

| 1 | Systolic BP | | | Diastolic BP | | |
|---|---|---|---|---|---|---|
| Time hours | Group(R) | Group(N) | p value | Group(R) | Group(N) | p value |
| 1 | 107.12±4.59 | 106.2±43.28 | >0.05 | 68.32±4.19 | 68.60±4.19 | >0.05 |
| 2 | 104.24±5.15 | 108.32±2.62 | <0.05 | 65.12±4.12 | 67.12±2.89 | <0.05 |
| 3 | 103.74±5.07 | 106.24±3.48 | <0.05 | 63.36±5.62 | 66.96±4.00 | <0.05 |
| 4 | 103.76±3.75 | 106.72±2.91 | <0.05 | 62.16±4.24 | 64.72±3.24 | <0.05 |
| 5 | 103.56±3.32 | 106.48±3.93 | <0.05 | 62.80±3.74 | 64.80±2.71 | <0.05 |
| 6 | 104.32±3.14 | 107.68±3.68 | <0.05 | 63.68±3.35 | 66.64±3.09 | <0.05 |

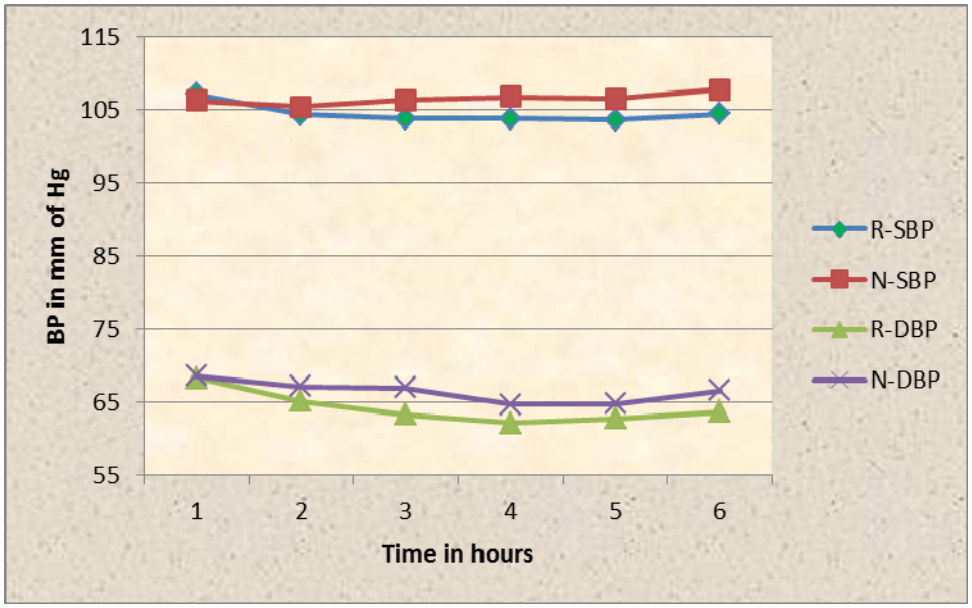


***Fig.11. Line diagram for postoperative blood pressure in mmHg***

Both R and N groups had a very normal mean systolic BP and diastolic BP in all analyzed intervals which shows a statistically significant 'p' value ($p < 0.05$) except in the 1st hour which showed statistically insignificant value ($p > 0.05$).

***Table 8: Total Tramadol requirement***

| Groups | N | Mean | Std.deviation | Std.Error | p value |
|---|---|---|---|---|---|
| R | 25 | 104 | 4.38 | 0.89 | |
| N | 25 | 324 | 26.15 | 5.34 | <0.05 |

***Table 9: Time for first demand of analgesic in minutes***

| Group | N | Mean | Std.deviation | Std.Error | p value |
|---|---|---|---|---|---|
| R | 25 | 290.00 | 20.9414 | 4.1883 | <0.05 |
| N | 25 | 81.00 | 8.9629 | 1.7925 | |

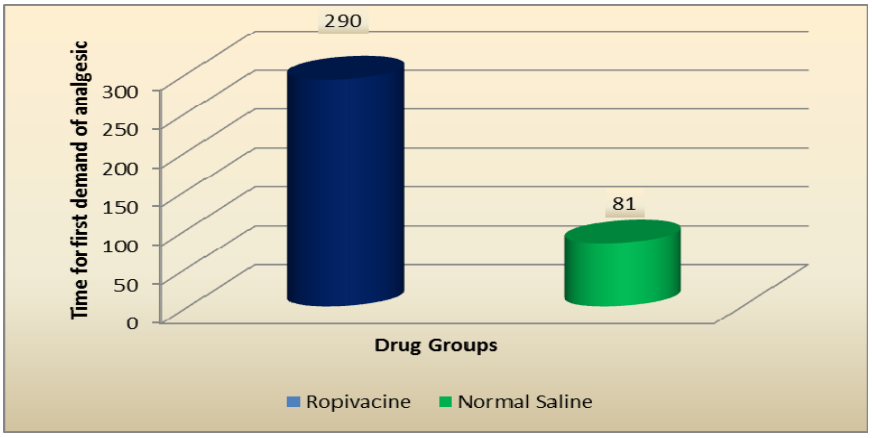


***Fig 12 .Bar chart for first demand of analgesic***

Total Tramadol consumption was less in Ropivacaine group (104±4.38mg) than in Normal saline group (324±26.15 mg), the mean difference of 220mg with $p<0.05$ was statistically significant as shown in (table 9), likewise the mean time for first request of rescue analgesic was 290±20.94 minutes in Ropivacaine group, when compared with 81±1.79 minutes in the Normal saline group which is nearly 3½ times lesser than Ropivacaine group. The difference of 209 minutes with $p<0.05$ was statistically very significant as shown in (fig. 12).

## DISCUSSION

Pain after caesarean section is often severe. Effective analgesia has shown to reduce postoperative stress response and accelerate recovery, early ambulation, infant care (including breast feeding, maternal-infant bonding) and prevention of postoperative morbidity from caesarean section. It is well recognized that local anaesthetic techniques can improve the quality of postoperative recovery by reducing pain and analgesic requirements.

We conducted a randomized, double-blind, case-control study to evaluate the postoperative analgesic efficacy and opioid sparing effect of TAP block which was based on *McDonnell et al*,[4] management of postoperative pain secondary to caesarean section by the use of a single-shot TAP block.

Caesarean section under regional anesthesia provides an excellent opportunity to perform TAP block. Injection in the postoperative period avoids operating room time delays, and by that time the neonate has already been delivered and is not placed at risk. So we performed TAP block at the end of surgery.

In our study we used 20 ml of 0.375% Ropivacaine or Normal saline on each side for TAP block which is comparable to *McDonnell et al,*[4] bilateral TAP block for caesarean section with 1.5 mg/kg of 0.75% ropivacaine (to a maximal dose of 150 mg) or saline on each side.

We selected Tramadol for rescue analgesia as several studies have confirmed the analgesic effects of single-dose intramuscular tramadol 50–100mg can provide effective postoperative analgesia comparable to that obtained with morphine, pentazocine and ketorolac.[66, 67, 68, 69]

Bilateral TAP block has been demonstrated to provide excellent analgesia to the skin and musculature of the anterior abdominal wall in patients undergoing caesarean section. All patients in Ropivacaine group breathed deeply, coughed freely, moved without limitation and showed good satisfaction as compared to Normal saline group.

Our study results had demonstrated that end operative TAP block reduced VAS score significantly in the study group at all the intervals when compared to control group. Interestingly the VAS score was zero in study group for the first 4 hours which itself explains the effectiveness of TAP block. VAS score even at the end of 24 hours was 50% less than the control

group. It is well correlated with the findings of *McDonnell JG et al*,[4] which explains the extension of pain relief by TAP block upto and beyond 24 hours. The reason for prolonged duration of analgesic effect after TAP blockade may be due to the relatively poor vascularisation and slowed drug clearance from Transversus abdominis plane, and may be due to avoidance of central sensitization by giving TAP block end operatively.

Ropivacaine group showed decreased HR and BP with statistical significance which could be explained by the pain mediated sympathetic stimulation (stress response) that occurred in early hours of postoperative period in Normal saline group.

In our study the mean time for first request of rescue analgesic was 290±20.94 minutes in Ropivacaine group, when compared with 81±1.79 minutes in the Normal saline group, the difference of 209 minutes with $p<0.05$ was statistically very significant as shown in (fig. 12). Total Tramadol consumption was less in Ropivacaine group (104±4.38mg) than in Normal saline group (324±26.15 mg), the mean difference of 220mg was statistically significant as shown in (table 9). Thus TAP block as a component of multimodal analgesia has decreased the total tramadol consumption and delayed the time for first demand of rescue analgesic by nearly 3½ times.

*McDonnell et al,*[4] demonstrated that the TAP block reduced overall postoperative morphine requirements by more than 70% in the first 48 postoperative hours and a longer time to first PCA morphine request.

*McDonnell et al,* [4, 23] demonstrated that even with the reduction in postoperative opioid requirements, the TAP block did not reduce the incidence or severity of PONV. This may have been because the amount of morphine consumed in the TAP block group was sufficient to induce PONV. In our study the incidence of PONV was very much reduced in both study group and control group because we had chosen a weaker opioid (i.m. Tramadol) when compared to Morphine which has proportionately higher incidence of PONV.

The only difficulty we expected during the study was blinding. Although patients and the investigator conducting the postoperative assessments were technically blinded to group allocation, true blinding may not have been possible as there would be an appreciable loss of sensation or paraesthesia associated with the TAP block. Investigators were strictly instructed to ask only VAS score and not to determine the level of sensory blockade in order to reduce the risk of blinding of group allocation.

Complications like peritoneal and visceral punctures related to TAP block were not encountered in our study. *Farooq M, Carey M.* in 2008[32] reported a case of Liver Trauma with a blunt regional anesthesia needle while performing Transversus Abdominis Plane Block. Thorough familiarity with anatomy, safe monitoring and injection technique, knowledge of local anaesthetic pharmacology and toxicity would prevent the possibility of complications and simplify the TAP block technique. These precautions will prevent major complications with TAP block. The use of ultrasound to confirm needle position is a promising approach that should further reduce the risk of this complication

## SUMMARY

This study has evaluated the analgesic efficacy and opioid sparing effect of Transversus abdominis plane (TAP) block for post operative analgesia after caesarean sections. The results of this prospective randomized double blinded study showed that TAP block with Ropivacaine as a multimodal analgesic regimen with i.m. Diclofenac as standard analgesic provided superior analgesic effect with reduction in postoperative VAS score, reduced mean opioid consumption and longer time for first request of rescue analgesia and without complications.

# CONCLUSION

Transversus abdominis plane (TAP) block as a component of multimodal analgesia provides highly effective postoperative analgesia in the first 24 hours after caesarean sections. As a component of multimodal analgesic regimen TAP block significantly reduced opioid consumption. TAP block was easy to perform, and provided reliable and effective analgesia in this study, and no complications due to the TAP block were detected.

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# PROFORMA

BILATERAL TRANSVERSUS ABDOMINIS PLANE BLOCK FOR POST OP ANALGESIA IN LSCS PATIENT

GROUP: DATE:

| | |
|---|---|
| NAME | IP.NO |
| ADDRESS | DIAGNOSIS |
| AGE | UNIT |
| SEX | SURGERY- LSCS |

**PREOPERATIVE**

| | |
|---|---|
| PULSE | CVS |
| BP | RS |
| HB | HEIGHT |
| URINE: SUGAR | WEIGHT |
| ALBUMIN | ASA RISK |

**INTRA OPERATIVE**

SURGERY – LSCS

MODE OF ANAESTHESIA: SUB ARACHNOID BLOCK

DRUG:

POSITION:

TIME:

SPACE:

MAX LEVEL OF SENSORY BLOCKADE BEFORE SURGERY

**INTRA OPERATIVE MONITORING**

| TIME(MTS) | 1 | 2 | 3 | 4 | 5 | 10 | 15 | 20 | 25 | 30 | 45 | 60 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PR | | | | | | | | | | | | |
| BP | | | | | | | | | | | | |

**POST OPERATIVE MONITORING**

LEVEL OF BLOCK

TIME OF TAP BLOCK

**MONITORING**

| TIME(HRS) | 1 | 2 | 3 | 4 | 5 | 6 | 12 | 18 | 24 |
|---|---|---|---|---|---|---|---|---|---|
| PR | | | | | | | | | |
| BP | | | | | | | | | |
| VAS SCORING | | | | | | | | | |
| DEMAND OF ANALGESICS | | | | | | | | | |

**SIDE EFFECTS**

| TIME (HRS) | 1 | 2 | 3 | 4 | 5 | 6 | 12 | 18 | 24 |
|---|---|---|---|---|---|---|---|---|---|
| LOCAL TOXICITY | | | | | | | | | |
| NAUSEA | | | | | | | | | |
| VOMITING | | | | | | | | | |
| SEDATION | | | | | | | | | |

**POST OP DRUGS**

1. ANALGESICS TIME DOSE
2. OTHERS

| DURATION OF ANALGESIA |
|---|

# MASTER CHART

| S. NO | Drug | Age (yrs) | Wt (kg) | Duration of surgery (mins) | P | P | P | P | P | P | P | P | P | Vitals-postopeative_ Heart rate (beats/minute) | | | | | | Vitals- Intra-operative- Blood Pressure (mmHg) | | | | | | | | | | | | First demand of analgesic (mins) | Total dose of tramadol (mg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 12 | 18 | 24 | 1hr | 2hr | 3hr | 4hr | 5hr | 6hr | 1hr | | 2hr | | 3hr | | 4hr | | 5hr | | 6hr | | | |
| 1 | 1 | 23 | 55 | 35 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 2 | 2 | 94 | 88 | 89 | 88 | 84 | 84 | 104 | 70 | 92 | 60 | 98 | 64 | 98 | 60 | 100 | 62 | 102 | 60 | 300 | 100 |
| 2 | 1 | 22 | 54 | 40 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 2 | 2 | 102 | 96 | 102 | 90 | 90 | 94 | 100 | 60 | 102 | 60 | 98 | 60 | 104 | 60 | 100 | 60 | 102 | 58 | 320 | 100 |
| 3 | 1 | 24 | 60 | 40 | 0 | 0 | 0 | 0 | 2 | 2 | 3 | 2 | 2 | 98 | 94 | 95 | 99 | 90 | 92 | 107 | 62 | 102 | 64 | 100 | 60 | 106 | 62 | 104 | 62 | 104 | 64 | 280 | 100 |
| 4 | 1 | 21 | 55 | 38 | 0 | 0 | 0 | 0 | 3 | 1 | 2 | 2 | 2 | 110 | 105 | 96 | 102 | 98 | 98 | 112 | 70 | 110 | 66 | 104 | 60 | 106 | 62 | 108 | 64 | 106 | 62 | 310 | 100 |
| 5 | 1 | 26 | 58 | 45 | 0 | 0 | 0 | 0 | 3 | 2 | 2 | 3 | 2 | 106 | 104 | 95 | 90 | 92 | 94 | 102 | 66 | 100 | 64 | 96 | 58 | 108 | 60 | 104 | 62 | 108 | 64 | 260 | 150 |
| 6 | 1 | 24 | 48 | 30 | 0 | 0 | 0 | 0 | 1 | 3 | 2 | 2 | 2 | 102 | 98 | 96 | 93 | 96 | 90 | 104 | 66 | 108 | 64 | 104 | 56 | 106 | 62 | 102 | 58 | 100 | 60 | 325 | 100 |
| 7 | 1 | 30 | 62 | 35 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 2 | 2 | 108 | 102 | 96 | 90 | 97 | 92 | 110 | 66 | 102 | 64 | 108 | 60 | 108 | 60 | 100 | 64 | 102 | 60 | 290 | 100 |
| 8 | 1 | 28 | 60 | 42 | 0 | 0 | 0 | 0 | 3 | 1 | 2 | 2 | 2 | 96 | 99 | 105 | 92 | 90 | 90 | 108 | 68 | 104 | 62 | 104 | 62 | 100 | 60 | 106 | 62 | 110 | 64 | 275 | 100 |
| 9 | 1 | 24 | 58 | 30 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 3 | 2 | 106 | 98 | 102 | 95 | 96 | 92 | 101 | 62 | 98 | 60 | 102 | 60 | 100 | 62 | 100 | 60 | 104 | 62 | 300 | 100 |
| 10 | 1 | 20 | 54 | 34 | 0 | 0 | 0 | 0 | 3 | 1 | 2 | 2 | 2 | 98 | 92 | 92 | 90 | 88 | 89 | 110 | 68 | 108 | 70 | 116 | 72 | 100 | 66 | 102 | 66 | 104 | 64 | 270 | 100 |
| 11 | 1 | 23 | 55 | 35 | 0 | 0 | 0 | 0 | 2 | 1 | 3 | 2 | 2 | 94 | 88 | 89 | 88 | 84 | 84 | 104 | 70 | 98 | 60 | 98 | 64 | 106 | 60 | 100 | 62 | 102 | 60 | 280 | 100 |
| 12 | 1 | 25 | 59 | 40 | 0 | 0 | 0 | 0 | 3 | 1 | 2 | 2 | 2 | 92 | 98 | 94 | 96 | 88 | 92 | 108 | 68 | 102 | 60 | 100 | 62 | 100 | 58 | 100 | 60 | 104 | 66 | 265 | 100 |
| 13 | 1 | 31 | 53 | 36 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 2 | 2 | 95 | 95 | 92 | 86 | 89 | 95 | 110 | 70 | 106 | 68 | 102 | 64 | 104 | 62 | 104 | 62 | 108 | 64 | 315 | 100 |
| 14 | 1 | 26 | 60 | 42 | 0 | 0 | 0 | 0 | 2 | 1 | 3 | 2 | 2 | 108 | 103 | 102 | 98 | 96 | 94 | 110 | 72 | 108 | 70 | 106 | 68 | 106 | 64 | 106 | 60 | 106 | 60 | 260 | 150 |
| 15 | 1 | 24 | 53 | 35 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 2 | 2 | 106 | 102 | 99 | 96 | 95 | 95 | 104 | 68 | 100 | 64 | 100 | 58 | 104 | 60 | 102 | 60 | 102 | 66 | 310 | 100 |
| 16 | 1 | 27 | 49 | 36 | 0 | 0 | 0 | 0 | 2 | 1 | 3 | 2 | 2 | 104 | 96 | 100 | 98 | 94 | 90 | 102 | 64 | 102 | 60 | 98 | 56 | 98 | 56 | 100 | 58 | 100 | 60 | 275 | 100 |
| 17 | 1 | 25 | 56 | 30 | 0 | 0 | 0 | 0 | 1 | 3 | 2 | 3 | 2 | 98 | 92 | 90 | 94 | 98 | 89 | 104 | 66 | 102 | 62 | 96 | 54 | 102 | 56 | 100 | 58 | 100 | 60 | 290 | 100 |
| 18 | 1 | 29 | 55 | 45 | 0 | 0 | 0 | 0 | 3 | 1 | 2 | 2 | 2 | 98 | 95 | 96 | 90 | 92 | 90 | 114 | 76 | 112 | 70 | 108 | 70 | 106 | 68 | 107 | 70 | 100 | 68 | 270 | 100 |
| 19 | 1 | 23 | 58 | 40 | 0 | 0 | 0 | 0 | 2 | 1 | 3 | 2 | 2 | 102 | 98 | 95 | 97 | 94 | 92 | 120 | 80 | 116 | 74 | 108 | 78 | 114 | 74 | 110 | 72 | 112 | 70 | 275 | 100 |
| 20 | 1 | 26 | 54 | 38 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 2 | 2 | 98 | 93 | 96 | 92 | 102 | 90 | 106 | 68 | 104 | 66 | 102 | 62 | 100 | 60 | 104 | 64 | 104 | 68 | 320 | 100 |
| 21 | 1 | 30 | 62 | 38 | 0 | 0 | 0 | 0 | 3 | 1 | 2 | 3 | 2 | 102 | 105 | 100 | 102 | 96 | 94 | 108 | 70 | 108 | 68 | 108 | 66 | 106 | 68 | 110 | 68 | 106 | 68 | 265 | 100 |
| 22 | 1 | 32 | 53 | 33 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 2 | 2 | 94 | 96 | 90 | 98 | 88 | 95 | 110 | 70 | 108 | 70 | 98 | 68 | 100 | 64 | 102 | 66 | 104 | 68 | 315 | 100 |
| 23 | 1 | 24 | 56 | 36 | 0 | 0 | 0 | 0 | 2 | 1 | 3 | 3 | 2 | 96 | 93 | 92 | 90 | 90 | 90 | 102 | 68 | 100 | 64 | 106 | 66 | 102 | 60 | 108 | 60 | 106 | 66 | 280 | 100 |
| 24 | 1 | 22 | 50 | 35 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 2 | 2 | 106 | 103 | 94 | 101 | 94 | 92 | 108 | 70 | 106 | 68 | 104 | 66 | 104 | 60 | 104 | 62 | 106 | 64 | 310 | 100 |
| 25 | 1 | 26 | 58 | 45 | 0 | 0 | 0 | 0 | 3 | 1 | 2 | 2 | 2 | 98 | 94 | 95 | 90 | 96 | 98 | 110 | 70 | 108 | 70 | 110 | 70 | 106 | 70 | 106 | 68 | 106 | 66 | 285 | 100 |
| 1 | 2 | 30 | 55 | 40 | 0 | 6 | 3 | 5 | 5 | 5 | 4 | 5 | 4 | 108 | 105 | 106 | 102 | 101 | 98 | 108 | 68 | 108 | 66 | 108 | 68 | 106 | 66 | 108 | 64 | 108 | 68 | 80 | 300 |
| 2 | 2 | 27 | 60 | 45 | 0 | 5 | 3 | 6 | 4 | 5 | 5 | 5 | 5 | 105 | 101 | 96 | 96 | 96 | 93 | 112 | 70 | 110 | 68 | 106 | 70 | 108 | 72 | 108 | 68 | 106 | 68 | 90 | 350 |
| 3 | 2 | 23 | 56 | 30 | 2 | 6 | 4 | 5 | 6 | 5 | 5 | 4 | 4 | 102 | 96 | 95 | 95 | 94 | 92 | 104 | 68 | 110 | 66 | 110 | 62 | 104 | 60 | 106 | 62 | 100 | 62 | 75 | 350 |
| 4 | 2 | 28 | 56 | 38 | 0 | 5 | 3 | 4 | 6 | 5 | 5 | 5 | 4 | 102 | 106 | 98 | 97 | 100 | 80 | 112 | 70 | 102 | 66 | 100 | 68 | 104 | 60 | 100 | 64 | 108 | 64 | 75 | 300 |
| 5 | 2 | 22 | 58 | 35 | 2 | 6 | 3 | 5 | 5 | 4 | 5 | 5 | 4 | 108 | 96 | 98 | 95 | 96 | 84 | 108 | 68 | 110 | 66 | 110 | 62 | 108 | 60 | 106 | 62 | 106 | 60 | 80 | 350 |
| 6 | 2 | 30 | 60 | 38 | 2 | 5 | 3 | 5 | 5 | 5 | 4 | 4 | 4 | 98 | 95 | 97 | 94 | 90 | 80 | 104 | 70 | 104 | 66 | 100 | 68 | 104 | 64 | 106 | 62 | 110 | 66 | 85 | 350 |
| 7 | 2 | 33 | 59 | 40 | 3 | 7 | 4 | 5 | 5 | 4 | 5 | 4 | 5 | 102 | 92 | 104 | 98 | 102 | 96 | 110 | 70 | 108 | 70 | 110 | 68 | 104 | 68 | 114 | 68 | 112 | 72 | 70 | 300 |
| 8 | 2 | 28 | 55 | 35 | 2 | 5 | 4 | 4 | 5 | 4 | 4 | 5 | 5 | 102 | 95 | 99 | 102 | 93 | 93 | 110 | 70 | 104 | 72 | 108 | 68 | 108 | 66 | 106 | 62 | 110 | 70 | 85 | 350 |
| 9 | 2 | 25 | 64 | 42 | 2 | 6 | 4 | 5 | 5 | 4 | 4 | 4 | 5 | 110 | 116 | 114 | 111 | 106 | 107 | 102 | 70 | 112 | 68 | 104 | 64 | 108 | 66 | 106 | 64 | 108 | 66 | 75 | 400 |
| 10 | 2 | 23 | 50 | 30 | 0 | 5 | 4 | 5 | 5 | 6 | 5 | 5 | 4 | 106 | 100 | 96 | 97 | 99 | 93 | 106 | 68 | 105 | 70 | 110 | 76 | 104 | 62 | 104 | 64 | 104 | 62 | 95 | 350 |
| 11 | 2 | 26 | 56 | 36 | 2 | 6 | 5 | 5 | 4 | 5 | 6 | 5 | 4 | 102 | 96 | 93 | 92 | 92 | 91 | 104 | 70 | 116 | 68 | 110 | 66 | 108 | 68 | 110 | 62 | 110 | 70 | 70 | 350 |
| 12 | 2 | 29 | 55 | 38 | 0 | 6 | 3 | 5 | 5 | 6 | 5 | 5 | 4 | 98 | 96 | 99 | 94 | 94 | 76 | 108 | 70 | 106 | 70 | 108 | 66 | 100 | 66 | 106 | 64 | 102 | 66 | 85 | 350 |
| 13 | 2 | 32 | 60 | 40 | 2 | 6 | 4 | 4 | 6 | 5 | 5 | 5 | 5 | 96 | 102 | 98 | 96 | 94 | 90 | 106 | 70 | 110 | 64 | 102 | 68 | 108 | 64 | 104 | 66 | 100 | 62 | 80 | 350 |
| 14 | 2 | 24 | 52 | 34 | 3 | 7 | 4 | 5 | 6 | 5 | 4 | 5 | 4 | 102 | 100 | 95 | 94 | 100 | 88 | 110 | 70 | 108 | 70 | 106 | 72 | 106 | 68 | 100 | 66 | 102 | 64 | 75 | 350 |
| 15 | 2 | 21 | 54 | 39 | 2 | 6 | 3 | 4 | 5 | 4 | 5 | 5 | 4 | 95 | 92 | 94 | 96 | 96 | 90 | 108 | 70 | 108 | 68 | 108 | 70 | 100 | 64 | 100 | 62 | 108 | 68 | 70 | 300 |
| 16 | 2 | 30 | 58 | 40 | 2 | 5 | 4 | 5 | 5 | 6 | 5 | 4 | 5 | 108 | 102 | 98 | 102 | 97 | 84 | 104 | 74 | 106 | 70 | 110 | 68 | 106 | 68 | 108 | 66 | 110 | 64 | 75 | 300 |
| 17 | 2 | 26 | 64 | 45 | 3 | 6 | 4 | 6 | 6 | 5 | 5 | 5 | 4 | 98 | 99 | 95 | 94 | 92 | 89 | 108 | 70 | 110 | 68 | 106 | 66 | 108 | 68 | 106 | 68 | 106 | 68 | 70 | 300 |
| 18 | 2 | 22 | 50 | 38 | 0 | 5 | 3 | 5 | 5 | 5 | 4 | 5 | 5 | 109 | 114 | 107 | 104 | 99 | 101 | 106 | 70 | 108 | 66 | 106 | 64 | 104 | 66 | 108 | 66 | 110 | 66 | 85 | 300 |
| 19 | 2 | 29 | 64 | 45 | 2 | 6 | 4 | 5 | 5 | 4 | 5 | 5 | 4 | 114 | 108 | 109 | 104 | 100 | 99 | 104 | 68 | 106 | 64 | 102 | 66 | 104 | 60 | 104 | 62 | 112 | 68 | 70 | 300 |
| 20 | 2 | 31 | 58 | 35 | 0 | 5 | 3 | 5 | 4 | 5 | 5 | 4 | 5 | 105 | 100 | 102 | 98 | 110 | 107 | 100 | 66 | 108 | 62 | 106 | 64 | 106 | 62 | 108 | 60 | 108 | 70 | 100 | 300 |
| 21 | 2 | 25 | 56 | 36 | 0 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 109 | 104 | 104 | 99 | 95 | 96 | 104 | 68 | 102 | 66 | 108 | 60 | 106 | 60 | 110 | 68 | 112 | 70 | 90 | 300 |
| 22 | 2 | 23 | 55 | 42 | 0 | 6 | 4 | 5 | 4 | 5 | 4 | 5 | 4 | 98 | 96 | 99 | 93 | 92 | 92 | 100 | 64 | 106 | 60 | 104 | 58 | 108 | 64 | 108 | 68 | 108 | 66 | 80 | 300 |
| 23 | 2 | 28 | 53 | 30 | 0 | 5 | 3 | 5 | 5 | 4 | 5 | 4 | 4 | 109 | 102 | 110 | 106 | 101 | 100 | 104 | 60 | 104 | 66 | 106 | 68 | 106 | 60 | 106 | 64 | 112 | 70 | 100 | 300 |
| 24 | 2 | 21 | 44 | 35 | 2 | 6 | 4 | 5 | 5 | 4 | 5 | 4 | 5 | 94 | 93 | 94 | 92 | 98 | 96 | 106 | 63 | 112 | 66 | 110 | 70 | 104 | 68 | 110 | 70 | 112 | 68 | 80 | 300 |
| 25 | 2 | 25 | 60 | 40 | 3 | 6 | 4 | 5 | 5 | 4 | 5 | 4 | 5 | 92 | 96 | 99 | 102 | 94 | 92 | 108 | 70 | 104 | 72 | 102 | 74 | 104 | 68 | 106 | 68 | 108 | 68 | 85 | 300 |